VRV IV

Setting the Standard Again

DAIKIN

Ali Beglar

VRV Experience;

Daikin UK 11 Years

Daikin US 6 Years

Daikin VRV Innovation

VRF is launched globally

1982

World's first VRV system is developed

1987

1st Heat Recovery

1990

First Inverter VRV

1991

Worlds first R410A VRV
Heating down to -4F
EEV in Branch Selector Box

1998

World's first R407C VRV
Auto Addressing (no rotary or dipswitches

2003

Continuous heating during defrost
Auto Charge
3280ft piping

2005

2007

2nd Generation VRV
Water Cooled
Technology

2014

© 2013 Daikin North America, LLC

VRV Range 2013

	Air Cooled		Water Cooled
Heat Pump	*VRV III 6-30 tons*	*VRV III S 3-4 tons*	*VRV-WIII 6-21 tons*
Heat Recovery	*VRV III 6-28 tons*		*VRV-WIII 6-21 tons*

© 2013 Daikin North America, LLC

VRV Range 2014

April 2014

	Air Cooled		Water Cooled
Heat Pump	*VRV IV 6-34 tons*	*VRV III S 3-4 tons*	*VRV-WIII 6-21 tons*
Heat Recovery	*VRV IV 6-36+ tons*		*VRV-WIII 6-21 tons*

October 2014

- **Development Concept = No 1 life Cycle cost**

© 2013 Daikin North America, LLC

VRV IV Heat Pump - What's the new standard?

New Standards:

1. Variable Refrigerant Temperature for increased comfort and efficiency
2. Larger capacity single modules and systems
3. VRV Configurator for simplified commissioning and servicing
4. IEER up to 28

Setting new standards…

VRV IV

© 2013 Daikin North America, LLC

VRV IV Heat Pump - What's the new standard?

But we don't stop there…

- Improved efficiency over all metrics
- All inverter compressors
- True optimization of diversity up to 200%
- 100 ft. Level difference between indoor units
- New Cassette and Ducted Indoor Units
- Connection of Mini Split Indoor Units
- Connection to other AHU's

© 2013 Daikin North America, LLC

Oh, and one more…

VRV IV Outdoor Units

ASSEMBLED IN THE USA!

$20M+ Investment

250 Additional Employees

© 2013 Daikin North America, LLC

We're Investing in North America

New VRV line in Houston

New Paint line

New Helium Mass Spec

© 2013 Daikin North America, LLC

A Global Team Working Together

Brazing Dojo

Braze Meisters Houston Goodman personnel

Daikin Systems Production

Training Houston personnel at Daikin's Japan facilities

Quality Kaizen Events

Leak reduction, 1st charge failures, and run test fallout

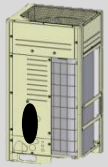
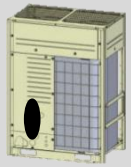
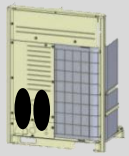
Line 8 Kaizen Event

Changeover reduction and line balancing

© 2013 Daikin North America, LLC

VRV IV Heat Pump

- **Simplified lineup**
  - Consistent for 230 and 460V system
- **Footprint of equivalent single modules same as VRV III**
- **All Inverter Compressors**
  - No starting current inrush

Capacity	Tons	6	8	10	12	14
	MBH	72	96	120	144	168
Model name	208/230V	RXYQ72TTJU	RXYQ96TTJU	RXYQ120TTJU	RXYQ144TTJU	RXYQ168TTJU
	460V	RXYQ72TYDN	RXYQ96TYDN	RXYQ120TYDN	RXYQ144TYDN	RXYQ168TYDN
Appearance						
Dimensions (in)		66-3/4 x 36-5/8 x 30-1/8	66-3/4 x 48-7/8 x 30-1/8			

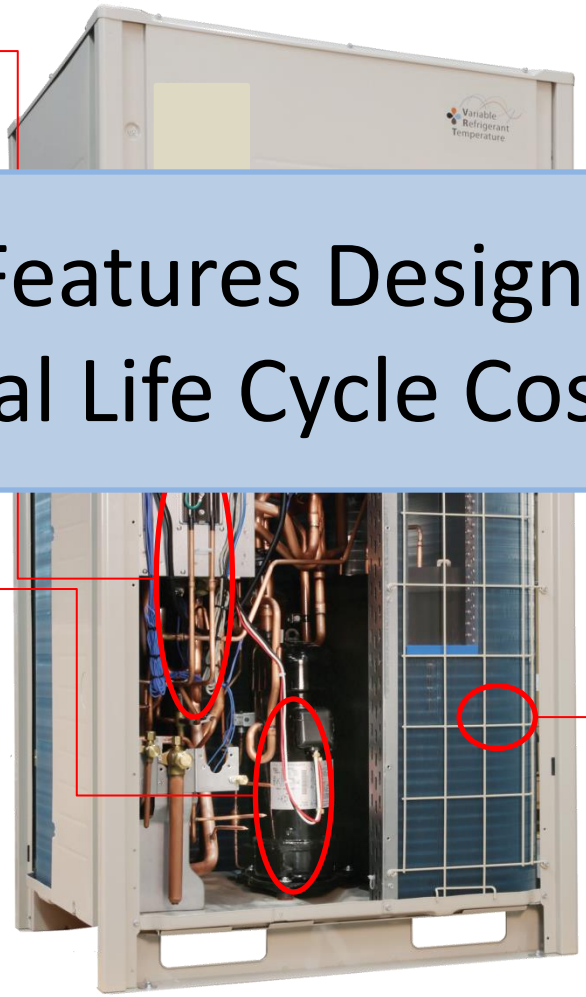
© 2013 Daikin North America, LLC

Additional New Technology

Inverter board cooled by refrigerant circuit

7mm coil -3 row

Improve heat exchanger efficiency



No ir

All VRV IV Features Designed to Optimize Total Life Cycle Cost (LCC)

New Compressor

New 6-pole motor

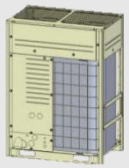
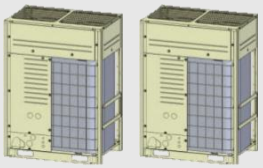
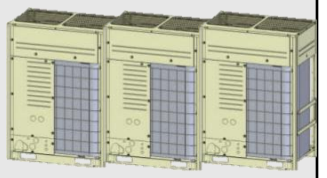
50% stronger magnetic force
2% higher efficiency at part load

4 sided coil

50% more heat exchanger surface

© 2013 Daikin North America, LLC

VRV IV HP – Larger Capacity Systems

Heat Pump	Capacity - Tons														
	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34
VRV III															
VRV IV															

Single Modules

Now up to 14 Tons
17% capacity increase

Double Modules

Now up to 28 Tons
40% capacity increase

Triple Modules

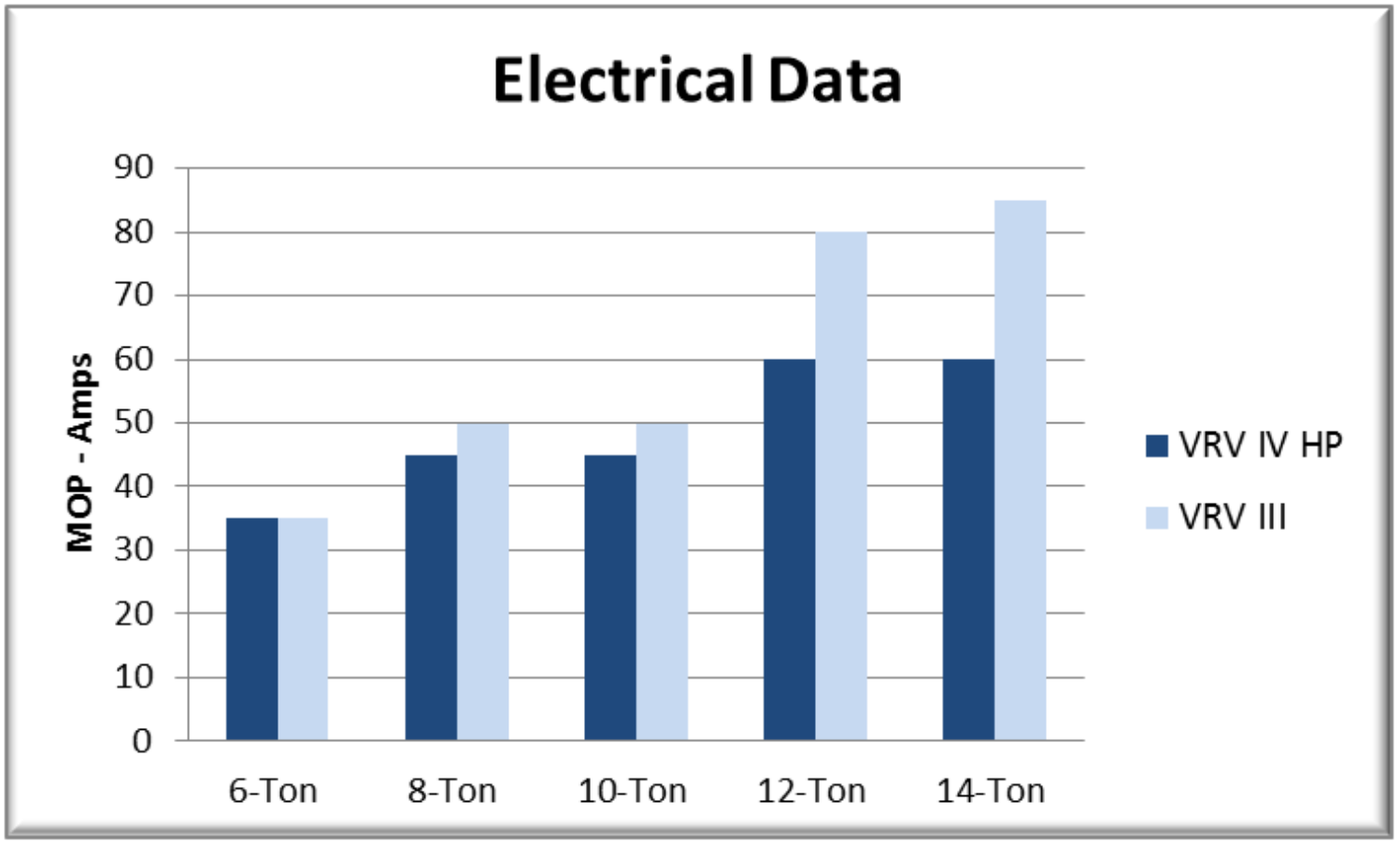
Now up to 34 Tons
13% capacity increase

- **Reduced install cost and time**
- **Up to 32% reduction in installed space**

© 2013 Daikin North America, LLC

VRV IV Electrical Improvements

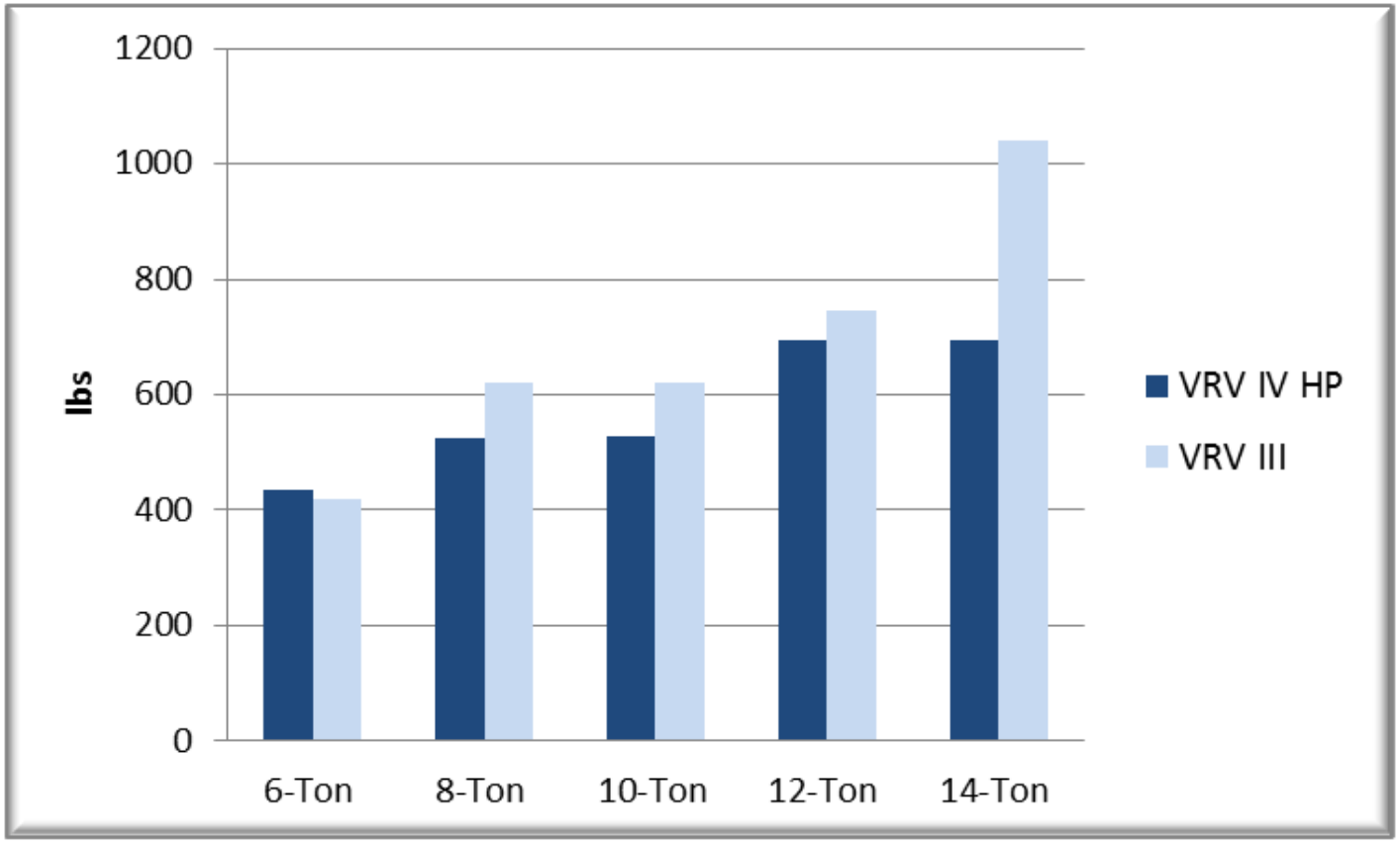
- **Up to 29% reduction in MOP to optimize install cost**



© 2013 Daikin North America, LLC

VRV IV Weight Improvements

- **Up to 33% improvement to reduce install cost and time**
- **Increased outdoor location flexibility**
  - Can help reduce roof load and construction



© 2013 Daikin North America, LLC

Seasonal Efficiency

Energy saving

Comfort

BUILDING LOAD

winter

summer

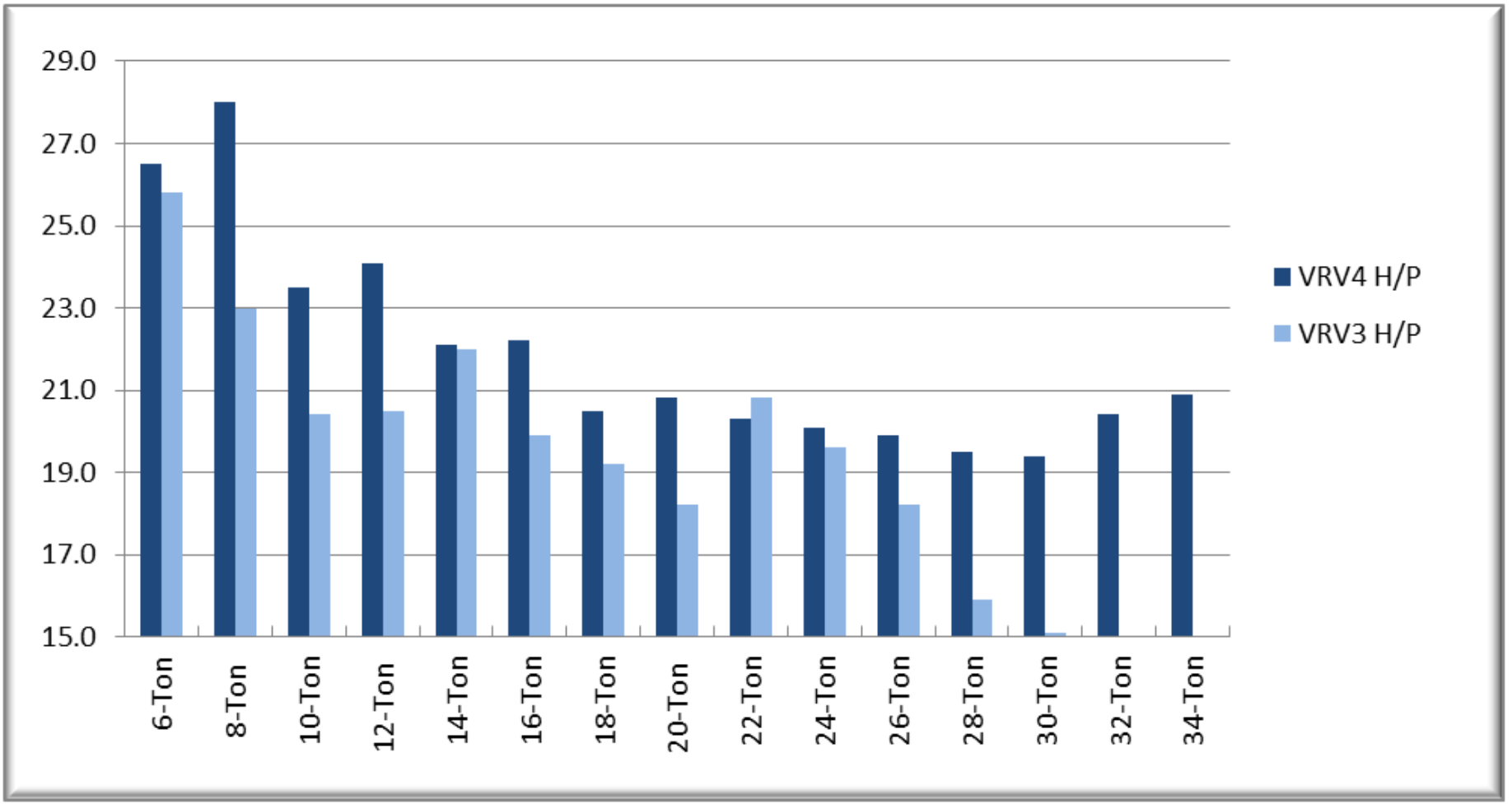
Fall

spring

© 2013 Daikin North America, LLC

Significantly Improved Efficiency

IEER improved by up to 28% over VRV III
Average of 11% over full range



© 2013 Daikin North America, LLC

VRF Capacity Control

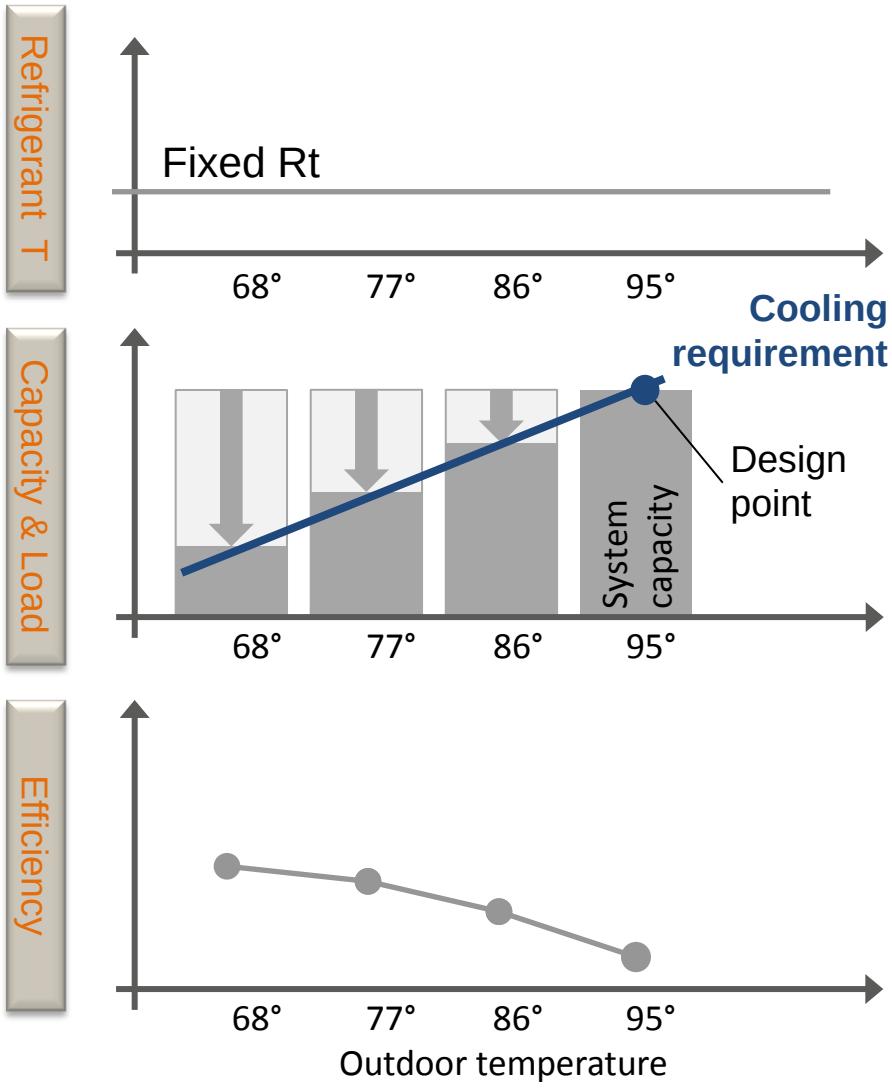
Currently on all VRF systems

Same refrigerant temperature (Rt) throughout the season

As outdoor temperature falls, the capacity of the system is adjusted by reducing the speed of inverter compressors

Reducing compressor speed improves efficiency, but only to a certain extent: at very low compressor speeds, compressor efficiency actually falls

Example: cooling



© 2013 Daikin North America, LLC

VRV IV

Variable
Refrigerant
Temperature

DAIKIN

Variable Refrigerant Temperature Control

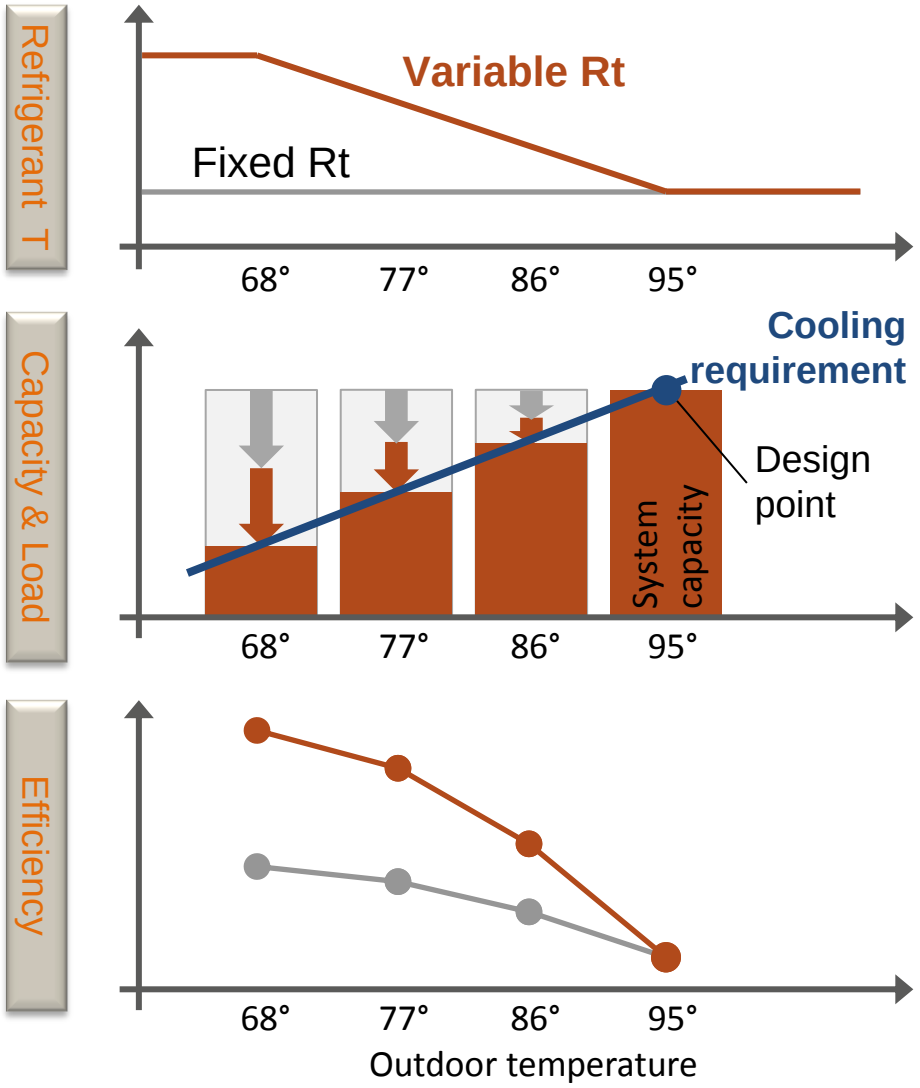
Automatic VRT mode

Higher refrigerant temperature (Rt) in mid-season

As outdoor temperature falls, the capacity of the system is adjusted by reducing the speed of compressors AND by increasing the evaporation temperature

Efficiency increases thanks to lower compression ratio and maintaining optimal compressor speed

Example: cooling



© 2013 Daikin North America, LLC

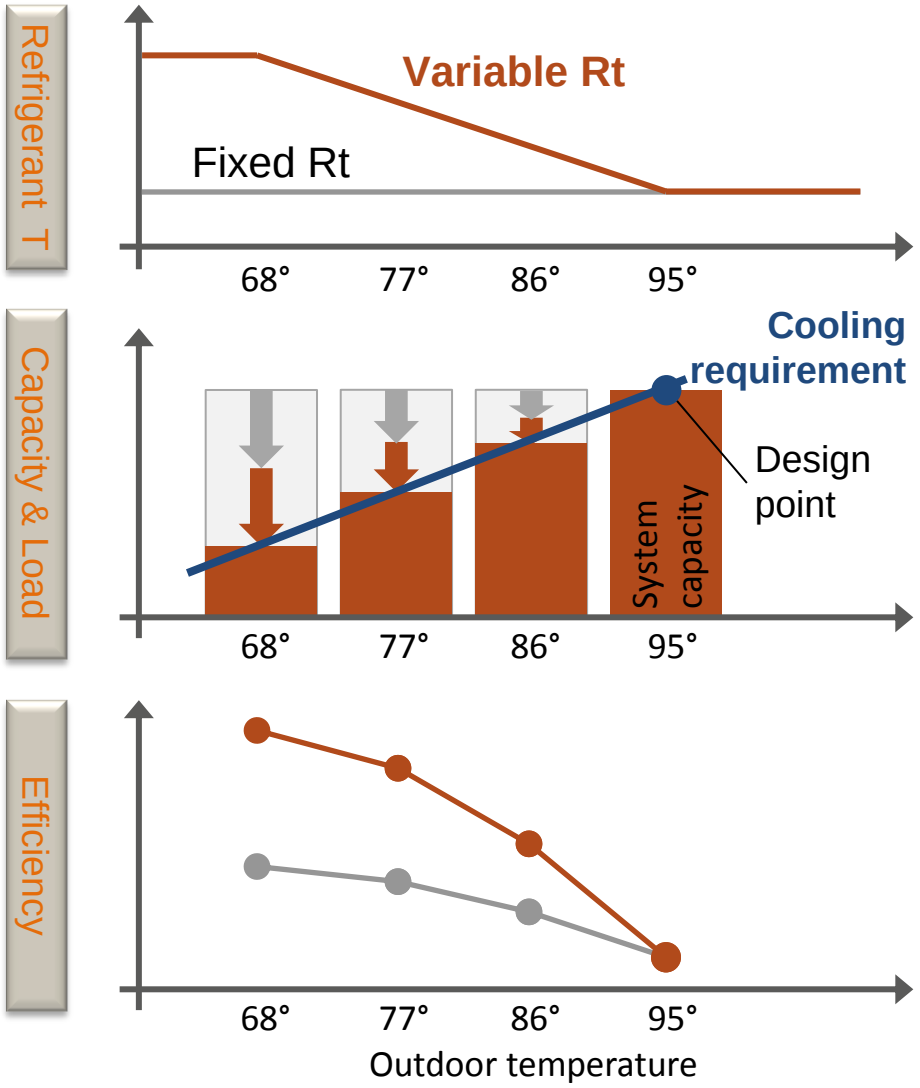
Variable Refrigerant Temperature Control

Automatic VRT mode

+28%
Seasonal cooling Efficiency

- **Reduced power consumption**
- **Reduced running costs**
- **Reduced CO_2 emissions**

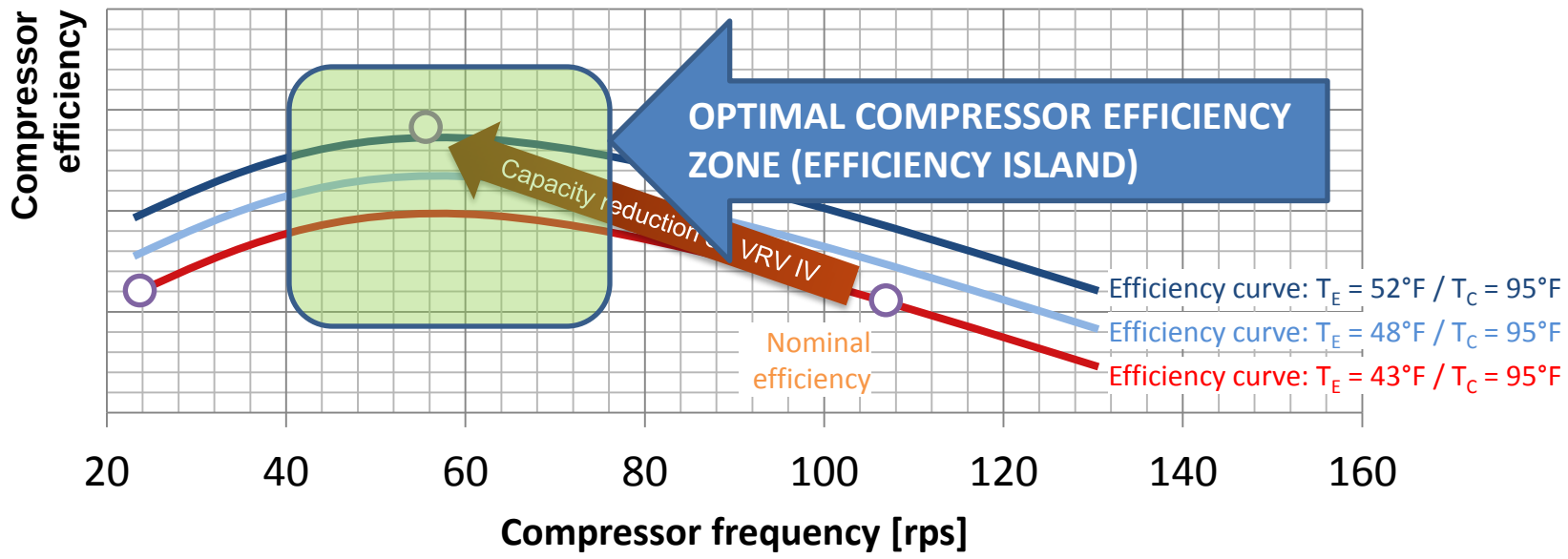
Example: cooling



© 2013 Daikin North America, LLC

Efficiency Benefit

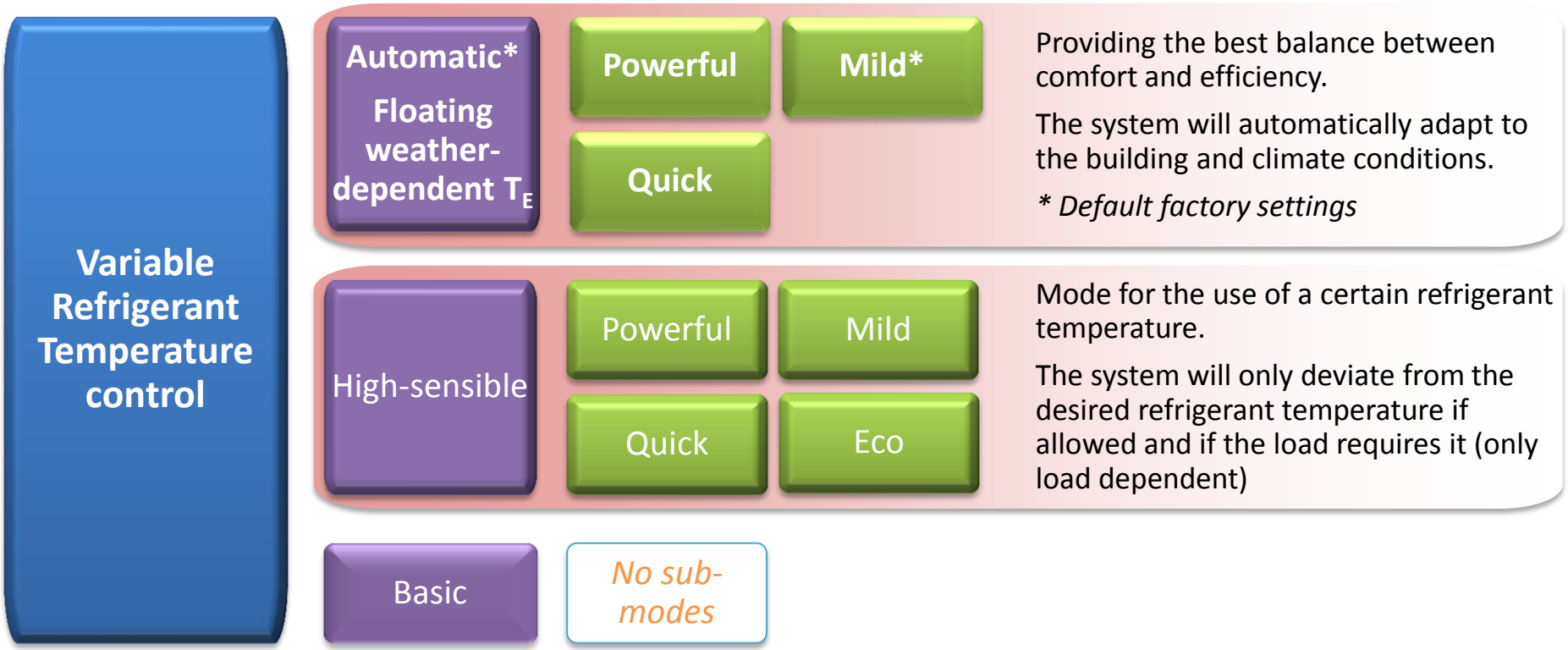
With a higher refrigerant temperature, the compression ratio falls so the compressor doesn't have to work so hard.
This prevents it from operating at it a less efficient low operating speeds.



© 2013 Daikin North America, LLC

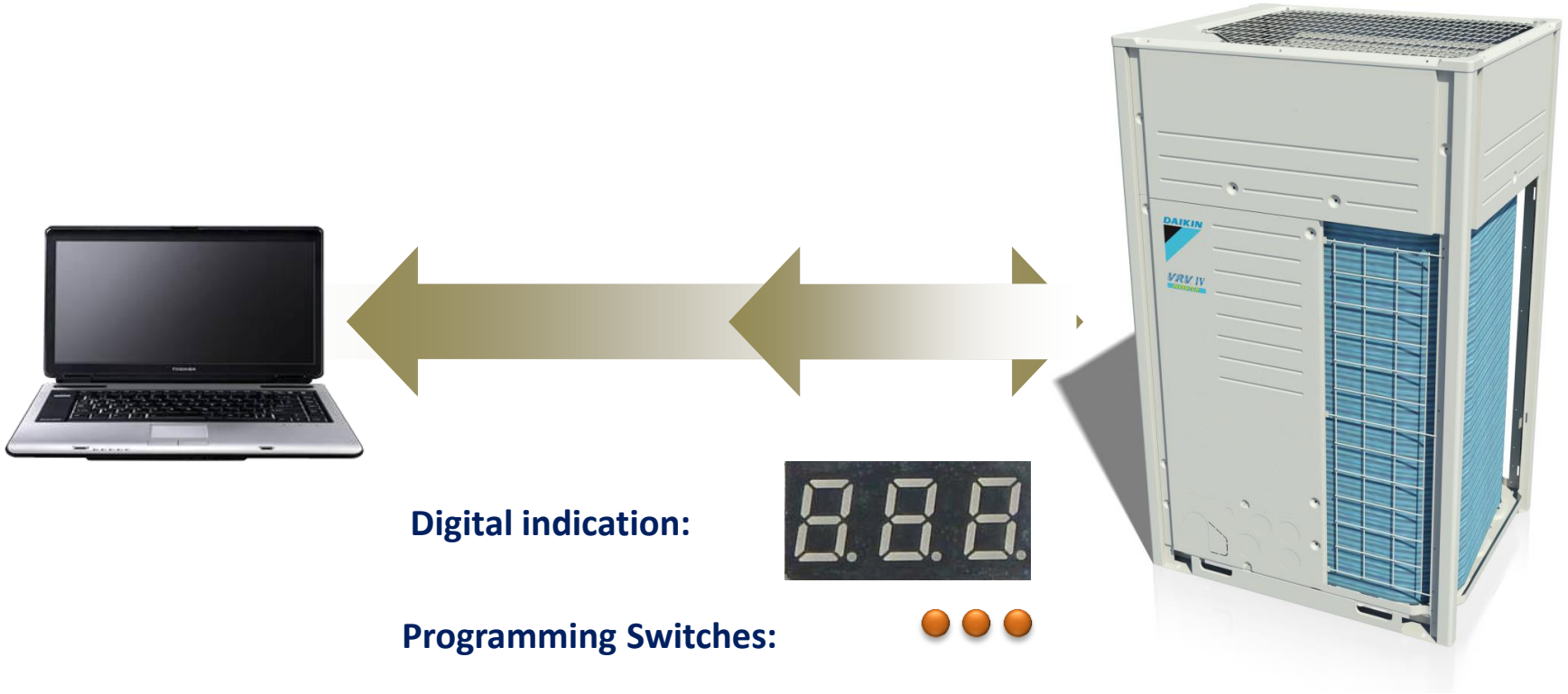
Variable Refrigerant Temperature Control

Variable Refrigerant Temperature control puts you in control of how the VRV IV operates, allowing customized, exact design based on the design and climate situation


Variable Refrigerant Temperature control
Automatic*
Floating weather-dependent T_E
Powerful
Mild*
Quick
Providing the best balance between comfort and efficiency.
The system will automatically adapt to the building and climate conditions.
* Default factory settings
High-sensible
Powerful
Mild
Quick
Eco
Mode for the use of a certain refrigerant temperature.
The system will only deviate from the desired refrigerant temperature if allowed and if the load requires it (only load dependent)
Basic
No sub-modes

© 2013 Daikin North America, LLC

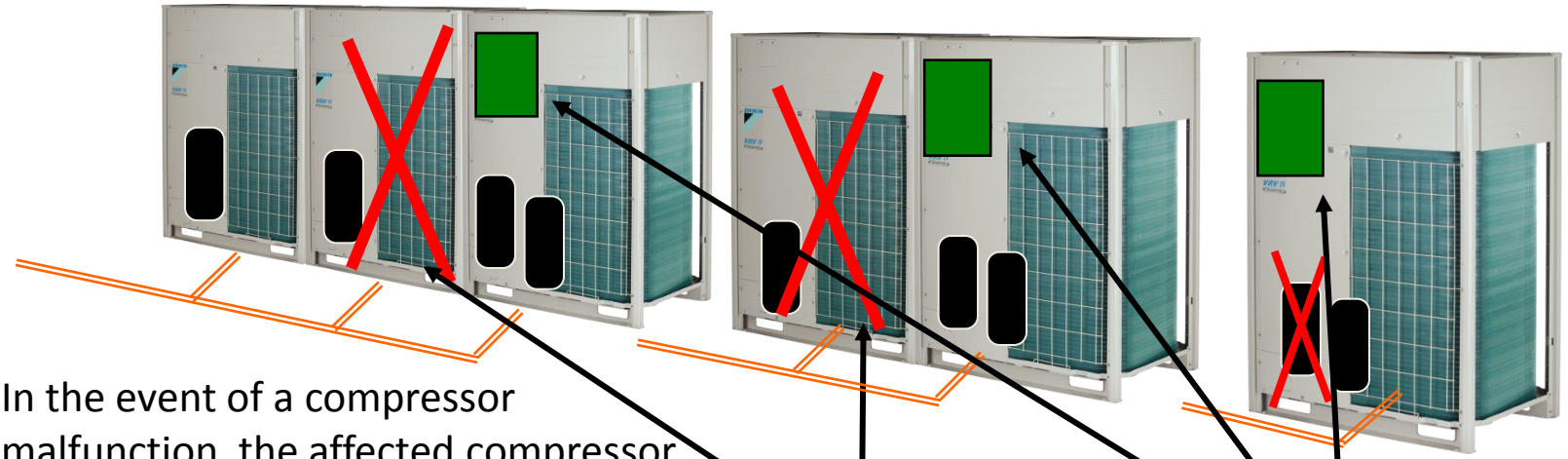
VRV IV Configurator



- Graphical interface to Configure System Settings and Commissioning
- Less Time on the roof required
- Commission multiple system of key accounts in the same way
- More time available for test run
- Easy error read-out

© 2013 Daikin North America, LLC

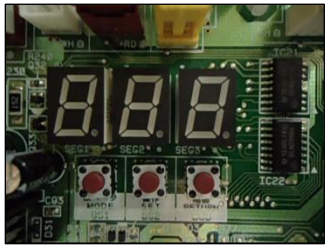
Emergency Operation



- In the event of a compressor malfunction, the affected compressor may be locked out by selecting Emergency Operation.
- VRV IV manifolded systems can have single compressor locked out if needed.

Press & hold ON-OFF button 5 sec.

OR



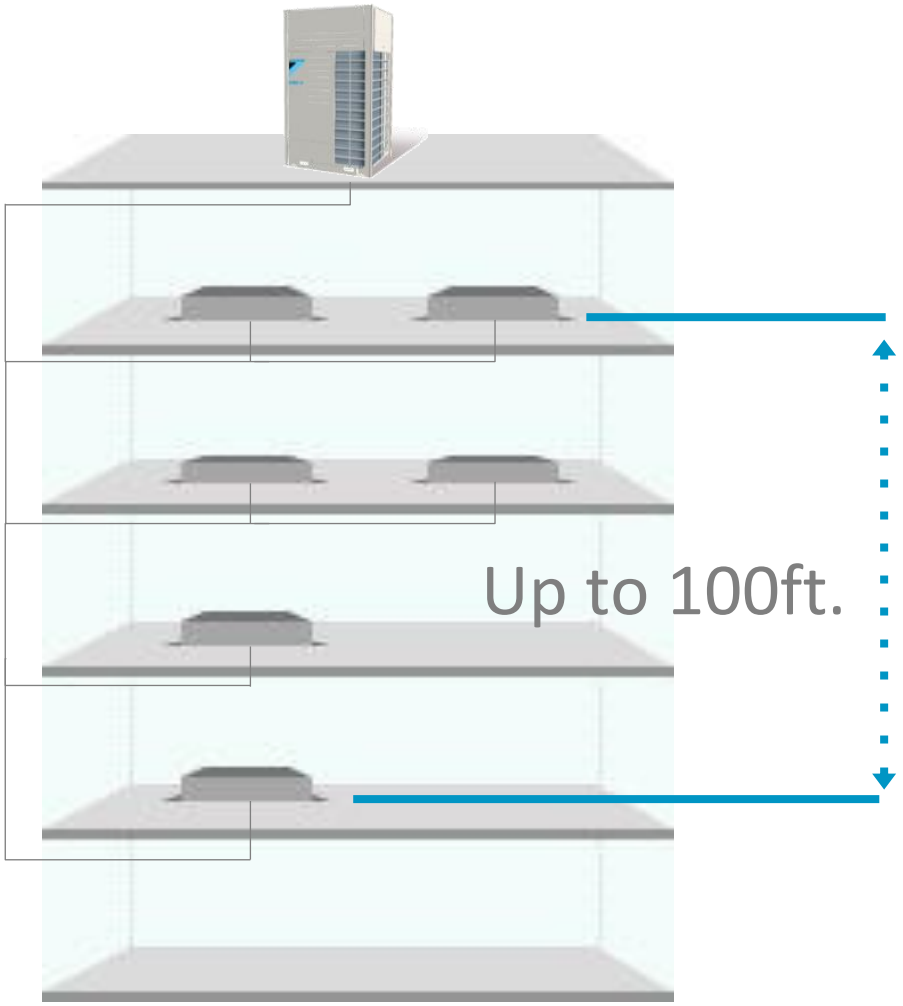
Field Setting on PCB

VRV IV units contain 1 or 2 Inverter driven scroll compressors based on model. VRV IV does not use a standard compressor

© 2013 Daikin North America, LLC

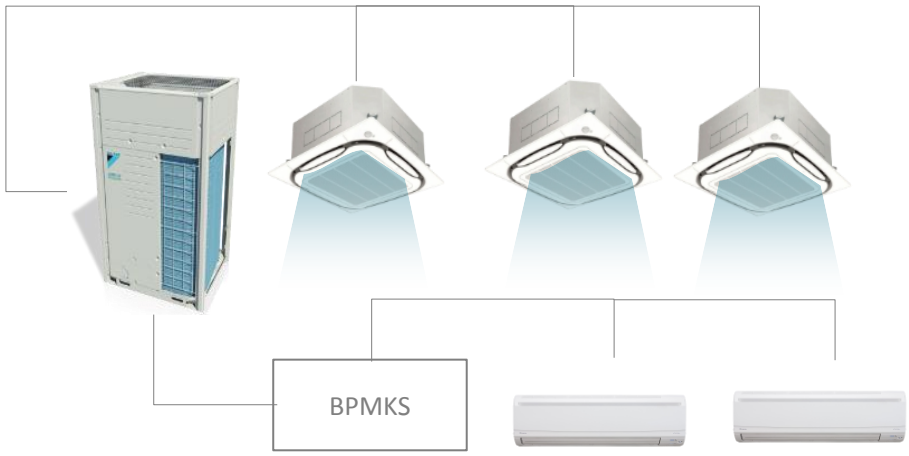
Expanded Piping Flexibility

- Greater flexibility for riser type piping layouts
- Allows for up to 12 floors to be served from a single VRV System
- Ideal for mid to high rise chiller or WSHP replacement projects



© 2013 Daikin North America, LLC

Mixing VRV and Split Type Indoor Units



2 & 3 Port options

- Mix of VRV and mini-split indoor units on same outdoor unit
- "Split only" also possible to be connected
- Single modules systems only
- Installation
  - Total piping length: 820ft
  - Longest length 328ft
  - Piping length after BP box to split: 49ft
  - Height difference BP box to split: 15ft

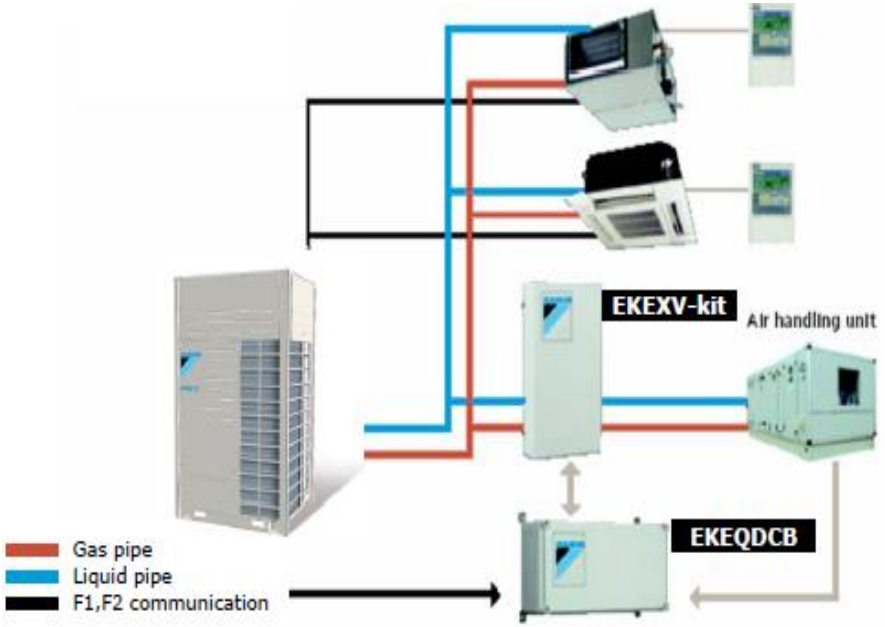
- **Provides residential type features such as auto fan mode and intelligent eye**
- **Removes refrigerant metering device from the space**
  - **Ideal for bedroom type applications**

Applicable Wall Mounted Indoor Units	
CTXS07LVJU	CTXS07JVJU
FTXS09LVJU	CTXS09HVJU
FTXS12LVJU	CTXS12HVJU

© 2013 Daikin North America, LLC

VRV IV – Total Solution

- **Other AHU can now be connected to VRV**
- **Providing ventilation and comfort cooling and heating**
  - Z control will operate the AHU like a VRV Indoor unit
  - X Control will allow control via 3rd party DDC (HP 1 to 1 only)



© 2013 Daikin North America, LLC

Indoor Unit for All Applications

2 New Indoor Units for 2014

April 2014

Wide range of well-designed indoor units

Roundflow Ceiling mounted cassette	4 way blow ceiling mounted cassette	Flat Panel Wall Mounted	Ceiling Suspended	Floor Mounted
Slim Ducted Ceiling Concealed	**DC Ducted Concealed ceiling**	**Concealed Floor Standing**	**Multi Position AHU**	**Large Capacity Celling Concealed**

© 2013 Daikin North America, LLC

New DC Ducted Concealed Unit –FXMQ_PA

New

- Expansion of range to include 15MBH and 54MBH
- Improved efficiency with DC fan motor
- Enhanced indoor air quality and LEED ready with MERV 13 filter options
- New economizer logic
- Ease of install with auto adjusting airflow at commissioning based on ductwork
- Flexible ductwork design with ESP capabilities up to 0.8" W.G.

Medium Static Ducted	MBH									
	7.5	9.5	12	15	18	24	30	36	48	54
Current	✓	✓	✓		✓	✓	✓	✓	✓	
New DC Duct	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Subject to depletion of current models

© 2013 Daikin North America, LLC

New VRV IV Heat Pump Lockout logic

- **New control logic to provide more application options for cold climates**
- **Outside temperature can now be measured directly from the outdoor unit coil sensor**
  - **Easier to install and lower cost**
  - Using a 3rd party thermostat is also still an option

Item	Description	Min	Max	Increments
Heat Pump Lockout Temp	Below this temperature, heat pump is locked out.	-15F (default)	50F	5F
Heat Pump Lockout Release differential	When the outdoor temp is recovered by this temp, heat pump is resumed.	5F, 10F (default), 15F		

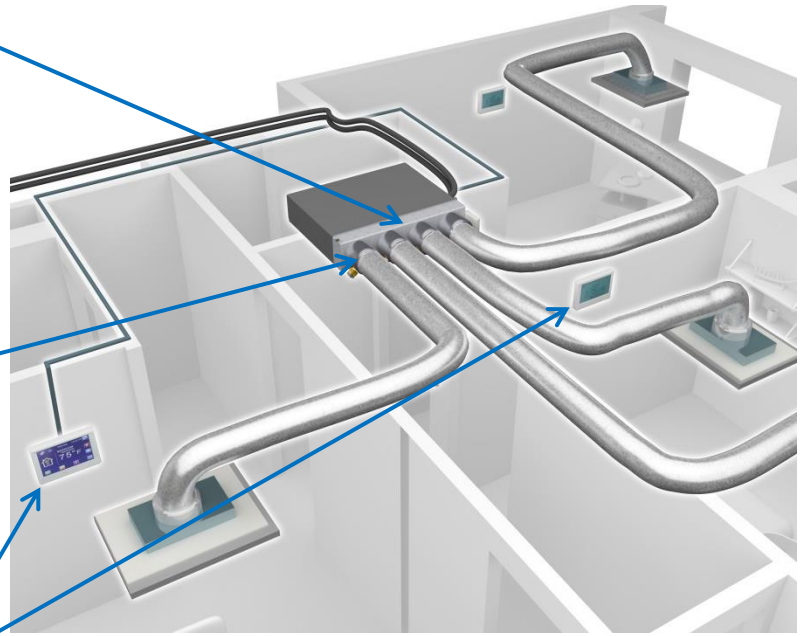
© 2013 Daikin North America, LLC

DZK – This is how it works

The **Zoning Box**, that contains motorized dampers and controls, mounts on the Daikin *VRV* indoor unit fan coil and integrates seamless with the *VRV* controls

The **Motorized Dampers** in the Zoning Box controls the air flow to each zone automatically

The **Main Thermostat** and the **Wireless Thermostats** in each zone allows the user to set the desired temperature, schedule, etc.



© 2013 Daikin North America, LLC

Round Flow Sensing Cassette FXFQ_T

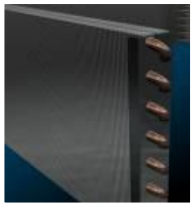
Complete unit and decoration panel redesign!

Adaptive Comfort Control!

Drasti… energy… levels a… flexibility

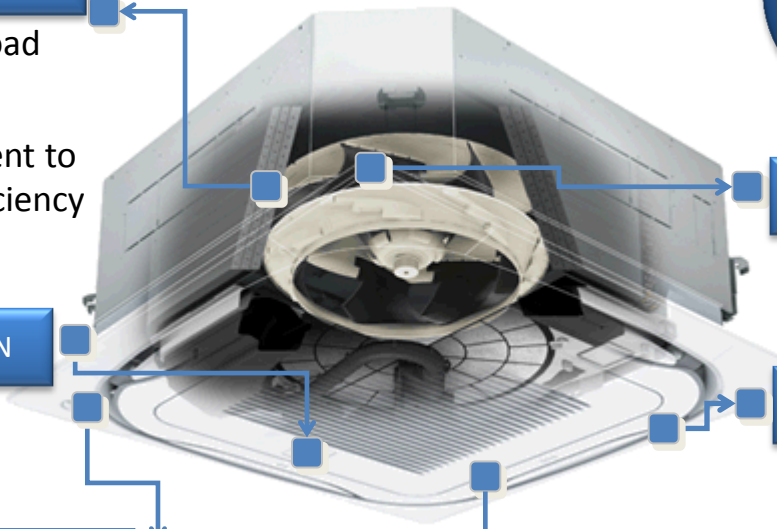
April 2014

NEWLY DESIGNED HEAT EXCHANGER



Optimized for part load operation

⇒ Great enhancement to seasonal energy efficiency



NEW DC FAN MOTOR

Improves energy efficiency and adds fan auto logic based on ΔT Setpoint

OPTIONAL AUTOCLEANING FUNCTION

- Maintain optimal efficiency & airflow

NEW DC DRAIN PUMP

New DC drain pump to reduce power consumption (previous AC drain pump)

STANDARD PRESENCE/OCCUPANCY & FLOOR /SURFACE SENSOR

- Further energy savings
- Increased comfort

NEW DECORATION PANEL

- Increased efficiency thanks to enlargement air discharge outlets
- Maintain current airflow pattern: unique 360° air distribution
- Increased flexibility thanks to possibility to close 1/2/3 flaps

Subject to depletion of current models

© 2013 Daikin North America, LLC

VRV IV Recovery - What's the New Standard?

Raising the Standard Further:

1. Variable Refrigerant Temperature for increased comfort and efficiency
2. Larger Capacity Single Modules and Systems
3. VRV Configurator for simplified commissioning and servicing
4. IEER up to 29+
5. SCHE up to 32+
6. Heating down to -13F as standard
7. Continuous heating during defrost and oil return
8. Dual Inverters

Setting new standards…

VRV IV

October 2014

Subject to depletion of current models

© 2013 Daikin North America, LLC

Take Away

- **As with all previous generations VRV IV has set the standard yet again**
- **Adding features to impact all aspects of the LCC**
  - Improved install cost
  - Improved efficiency operational cost
  - Improved maintenance costs

© 2013 Daikin North America, LLC

Thank You!

© 2013 Daikin North America, LLC